BOOK REVIEWS

ELIZABETH COWLES, DEPARTMENT EDITOR

ANIMALS

Frogs and Toads of the World. By Chris Mattison. 2011. Princeton University Press. (ISBN 9780691149684). 192 pages. Hardcover. $29.95.

There are probably few questions that a person might have about frogs and toads that are not answered in this book. In its detailed, wonderfully fascinating, and stunningly illustrated chapters, the reader will discover much about the origins and classification of frogs, their anatomy and physiology, their behavior and life cycles, and their place in the natural world.

Believed to be descended from lobe-finned fishes, modern amphibians are divided into three groups – frogs and toads, salamanders, and caecilians. Most prominent are the frogs and toads, which are grouped into 6000 species in 49 families. (It is noted that "scientists do not distinguish between toads and frogs.") A fairly thorough documentation of fossil remains tells the story of amphibian origins, but the author notes that "lack of fossil frogs made their history difficult to trace." Modern molecular studies have led to significant changes in their classification and to much disagreement among experts.

Frog anatomy, physiology, and behavior are presented in terms of the interesting assortment of adaptations that enable them to survive in a variety of environments. For example, the Lake Titicaca frog's greatly increased skin surface area for oxygen absorption is described as "folded and wrinkled to such an extent that it looks as though it has borrowed it from a much bigger frog." The frog's skin is also important in thermoregulation, with dark skin colors absorbing more heat than light colors. Some frogs also survive freezing temperatures by converting stored liver glycogen into a high level of glucose or glycerol, which acts as an antifreeze in their blood. Since frogs have adapted to many extremes in environment, it has enabled them to spread "into habitats such as deserts in which they face less competition."

Frogs eat whatever they can catch and swallow. Their main prey are insects, but some are known to eat fish, mollusks, worms, and even small reptiles and mammals. Two species are herbivorous. Most frogs use their tongues, which show a large variety of adaptations, to capture food. Frogs are also prey to a variety of organisms, from snakes and birds to tarantulas and even insectivorous plants. But they use many strategies to avoid being eaten. Toxins, camouflage, speed, and agility are common defense mechanisms. Some frogs will attack and others scream loudly to startle predators. Despite all these methods, many frogs "rely on the sheer weight of numbers of offspring to ensure that…enough individuals remain to form a new generation."

The only vertebrates that have an aquatic larval phase and a terrestrial adulthood, amphibians use external fertilization, laying their eggs in water, singly, or in clumps or chains. These hatch into free-living, tail-bearing, gill-breathing tadpoles that gradually metamorphose into lung-breathing terrestrial adults with legs. There are numerous variations on this life-cycle pattern, with desert frogs breeding in flooded areas after heavy rains, tadpoles being defended from predators by the mother, use of tree holes and bromeliads as breeding sites in forest habitats, and even breeding in the pitchers of pitcher plants. Some frogs even show a high level of parental care by laying eggs on land and carrying them to water or by carrying eggs on their backs or in pouches.

Frogs are found in a variety of habitats, mostly in or near water. Others live underground or in trees. Habitat destruction by logging, land clearance, and other activities has damaged many of their environments. Pollution, climate change, and disease have also taken their toll on frogs. Introduction of alien species in some habitats has reduced frog populations, and overexploitation of frogs for food, teaching, and research has led to declines in some frog populations.

The final chapter of the book is a wonderful catalog of the frog families. Although frog classification is still being overhauled, each of the currently recognized 49 families is described and illustrated, most of them in considerable detail. This chapter alone makes the book a valuable resource.

The book would be an inexpensive but significant addition to a biology classroom library. There is so much more to this volume than can be discussed in a review, including wonderful examples of how humans have interacted with frogs and how frogs have been a part of history and mythology. Many students are interested in frogs but probably know little about them. With this handy reference, teachers can provide information and good examples that enrich many biological topics, including ecology, evolution, adaptation, anatomy, physiology, classification, and behavior.

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Venomous Snakes of the World. By Mark O'Shea. 2011. Princeton University Press. (ISBN 9780691150239). 160 pages. Paperback. $19.95.

This is a handy and helpful guide to identifying venomous snakes from all over the world. The snakes are grouped by geographic locations, making it easier to identify a certain type of species, with beautiful, full-color photographs taken by the author.

One great point made in the book is how snakes are misunderstood. Most people are not aware of their importance in nature. "Many people fear snakes and see it as their duty to rid the planet, or at least their small patch of it, of the accursed serpent before it has the chance to turn the tables." The book

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will help educate people about the role of a snake in the environment. One way to help snakes is to educate people.

Another great point: "Snakes do not 'dislocate' their jaws, a process that would render them useless, they articulate them on the ball and socket joint where the jaw is hinged on the skull." So many people believe otherwise. Anyone who has seen a snake consume prey would deduce that they dislocate.

I have been working with snakes since the mid-1990s, but this book has taught me some new things, for example that snakes shed (slough) their tongues. This book has tons of great information for experts or for new snake enthusiasts.

There are a couple of changes that I would make, like placing the Global Distribution of Venomous Snakes map in the beginning of the book instead of the back, which would make it more user friendly. In addition, there should be pictures with labels of a snake's jaw and skeleton in the book's anatomy section. This would make the text more understandable.

This book could be used by professors who take their students on field studies or to teach the biology of snakes.

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MICROBIAL LIFE

March of the Microbes: Sighting the Unseen. By John L. Ingraham. 2010. The Belknap Press of Harvard University Press. (ISBN 9780674035829). 326 pages. Hardcover. $28.95.

Life on Earth as humans know it would not be possible without the variety and vast numbers of microorganisms that are frequently overlooked by most people. Some of these microbes are responsible for converting nitrogen, sulfur, and carbon-containing compounds into forms that benefit other organisms. A few are used in making foods and beverages. Others cause diseases. Visible evidence of these microbes abounds, from the holes left in Swiss cheese by *Propionibacterium shermanii* to the toxic black mold *Stachybotrys chartarum*, which threatens the health of residents of flood-damaged homes, to younger-looking faces thanks to a dilute solution of the toxin produced by *Clostridium botulinum*, to the fresh snow on the ski slope made by machines utilizing the corpses of *Pseudomonas syringae*.

Ingraham takes the reader on a series of "microbe sightings," using detailed examples to give the reader an appreciation for how humans' lives and environment are affected and shaped by bacteria, archaea, protozoa, fungi, and viruses. Within each themed chapter, he tells the story and history of several specific microbes, including a brief aside whenever the organism in question has a notable relative. For example, chapter 4, "Living Together," includes a section called "A Belching Cow." Here the reader learns the term *eructate*; that "a twenty-two gallon cow's rumen would be home to about a quadrillion microbes, about 200,000 times as many microbes as there are humans on Earth"; that the microorganisms produced in the rumen are "the ruminant's major source of protein"; that all five major types of microbes are present in the rumen; that dry dog food is treated so it has an odor similar to that of a rumen, but diluted in strength; and that certain Eskimo tribes that eat reindeer get sufficient vitamins by eating not just the meat, but also the contents of the reindeer rumens. Before the section is complete, cecal digestion of cellulose in organisms such as rodents, cellulose digestion in termites, and the possible use of some cellulose-digesting microbes in the production of biofuels are also discussed. This chapter has additional sections entitled "Spanish Moss," "A Fat Man and a Thin One," "A Gall on a Grapevine," "Small Points of Light on a Dead Fish," and "An Aphid Feasting on a Tender Rose Leaf." It also includes literary references from Jules Verne and Mark Twain; illustrations of how *Agrobacterium tumefaciens* transfers genes into a plant, and of an aphid eating while also giving birth; and stories of scientists from Carolus Linnaeus to Elie Metchnikoff to Jeff Gordon.

With a plethora of fascinating examples and engaging, engrossing writing, *March of the Microbes* is an excellent survey of microbial life that could even act as the text to accompany a high school elective on microbiology. Several AP Biology Readers who were coaxed into reading part or all of chapter 5, "Cycling Nitrogen," and learned of the anammox process were convinced of the merits of this book. (This process, discovered in the 1990s, may "account for as much as two-thirds of the flow of fixed nitrogen back to the atmosphere" in marine sediments and other environments.) The detailed lives of many organisms with various levels of impact on us and our world are presented with just enough detail to satisfy, even fascinate, but not overwhelm the reader.

Unfortunately, there are a few notable errors in the text, such as an indication that sperm do not contain mitochondria and one reversed arrow in a food chain diagram, thus showing methanogenic archaea using rather than producing methane. Hopefully such errors will be corrected before a paperback version of the book is issued. While there is a helpful glossary in which one can be reminded of what PM means (precursor metabolite), there is no bibliography. Thus, the reader must resort to an online search engine to find further information about a particular microbe. Nevertheless, when nearly every page presents nuggets to share with students and colleagues, and when the reader does not want to stop in the middle of a chapter, *March of the Microbes* must receive a high recommendation.

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SCIENCE EXPERIMENTS

Theo Gray's Mad Science: Experiments You Can Do at Home – But Probably Shouldn't. By Theo Gray. 2009. Black Dog & Leventhal Publishers. (ISBN 9781579128753). 239 pages. Paperback. $19.95.

This is a cookbook of science demonstrations guaranteed to make a big impression. Author Theo Gray says "I've tried to capture the fun and sense of adventure that comes with science, as well as its truth and beauty." He starts out with an introduction that includes a warning about the potential danger that some of these experiments can pose. He explains that with any chemistry there are potential risks, and that within this book there are experiments he would let his kids do but others that it would be crazy to try at home. One very prominent warning says "If you never read any warnings, please read this: Wear Safety Glasses!" The book includes experiments in chapters entitled "Experimental Cuisine," "Doomsday DIY," "Raw Power," "Playing with Fire," "Heavy Metal," "Natural Wonders," and "Twisted Shop Class." In the "Experimental Cuisine" chapter, Gray starts with an experiment that